



**ANNUAL SCIENTIFIC MEET: 2020 – 2021**  
**“MARINE MACRO ALGAL FLORA OF INDIA”**  
**Dated: 03<sup>rd</sup> & 4<sup>th</sup> April, 2021 Venue: BSI, Kolkata (Virtual Mode)**

**DR. M.PALANISAMY**  
Scientist - 'E'  
Botanical Survey of India  
Southern Regional Centre  
Coimbatore-03

**PROJECT TITLE: “Marine Macro Algal Flora of India”**

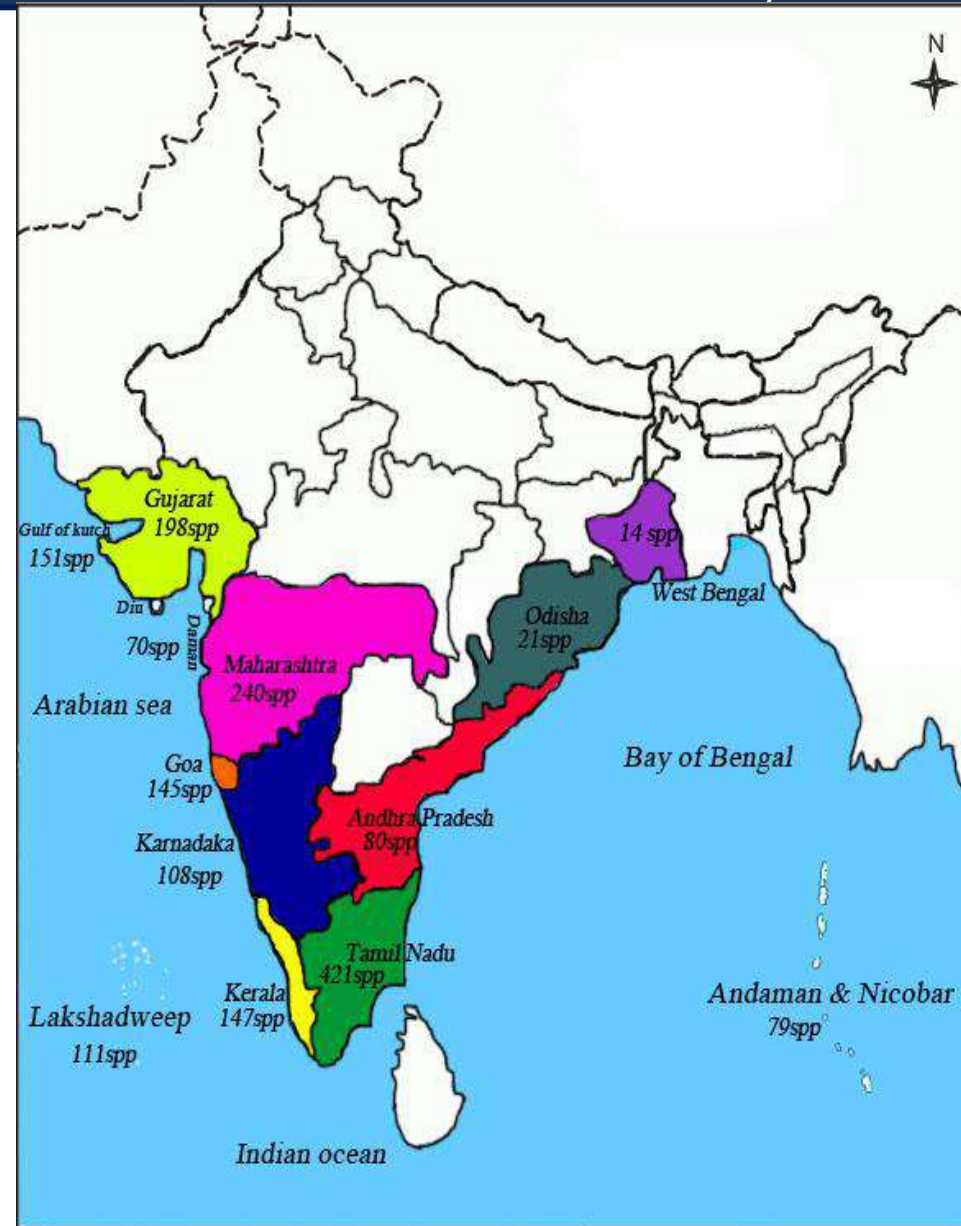
- ❖ **Executing officials:** Dr. M. Palanisamy, *Sci. - 'E'* & Dr. S. K. Yadav, *Botanist*
- ❖ **Date of initiation:** 01.04.2019
- ❖ **Date of completion:** 31.03.2022
  
- ❖ **Roles & Responsibilities of each of partner( s ):**
  - **Collection of literatures** pertaining to Marine Macro Algae (Seaweeds)
  - **Survey and collection of** Marine Macro Algae
  - **Recording the field data** such as Nature of the coast, Habit and habitat of seaweeds, GPS coordinates, associated species, Physico-chemical parameters.
  - **Preservation of Seaweeds** ( Herbarium Preparation)
  - **Observation of Morphological and Anatomical** characters of seaweeds.
  - **Herbarium consultation** and Identification of seaweeds
  - **Preparation and submission of manuscript** in the flora format of BSI on  
*“Marine Macro Algal Flora of India”*

➤ India ( $8^{\circ}$ - $37^{\circ}$  N and  $68^{\circ}$ - $97^{\circ}$  E) is a **peninsular country** with *ca* **7500 km long coastline**, with an **Exclusive Economic Zone (EEZ)** of around **2.5 million km<sup>2</sup>** spread into **9 coastal states and 4 UTs**.

➤ It has a very wide range of coastal ecosystems such as **estuaries, lagoons, mangroves, backwaters, salt marshes, rocky coasts, sandy stretches and coral reefs**.

➤ The Indian coasts consist in nearly on **43% of their total length of sandy beaches**, in **11% of rocky with headlands, platforms and cliffs**, and in **46% of mud flats and marshy wetlands**.

➤ The coastline of India shows **wide range of variability in its topography, geographical position and provides the great habitats** for the enormous diversity of marine macro algae.



# NATURE OF GUJARAT COAST



# NATURE OF GOA COAST



# Karnataka Coast



## NATURE OF KERALA COAST

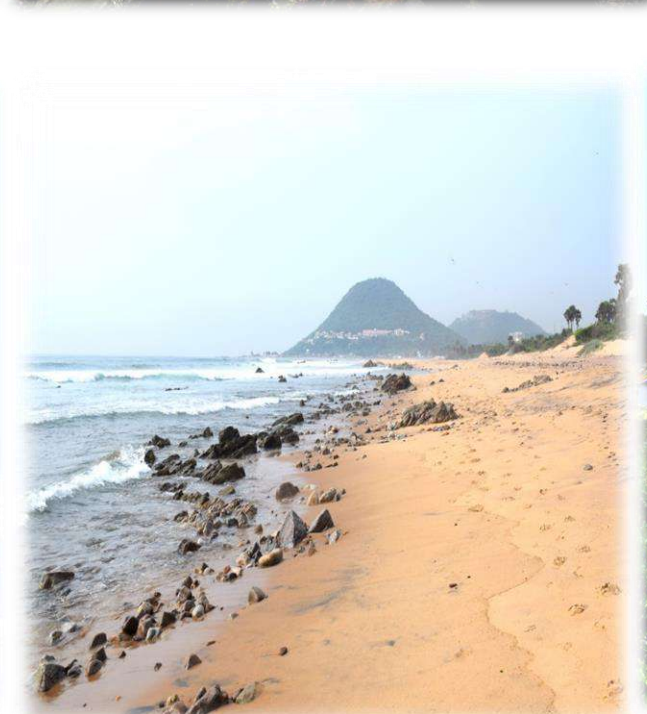
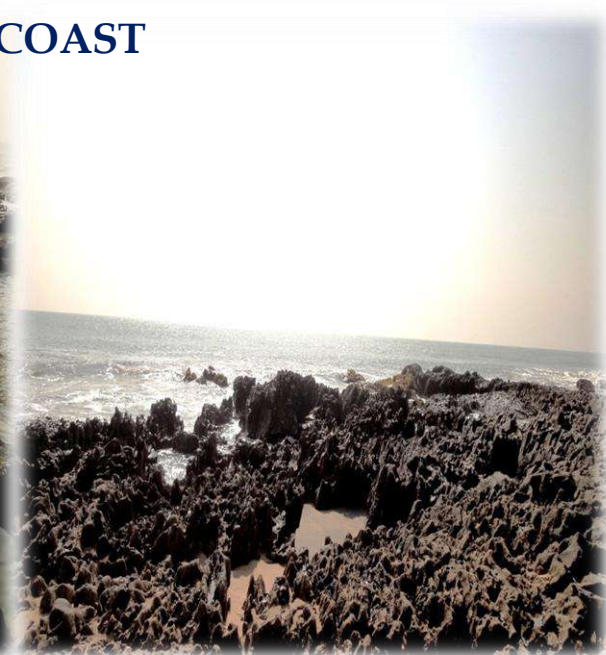
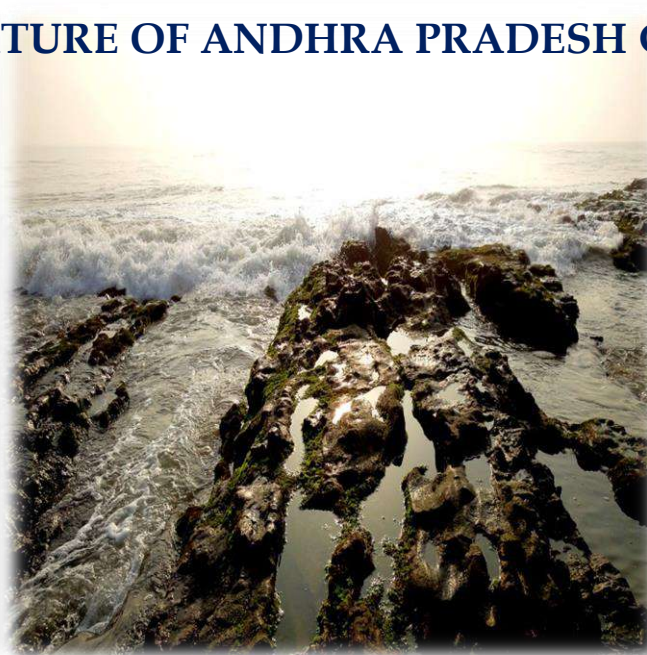


# NATURE OF TAMIL NADU COAST





# NATURE OF ANDHRA PRADESH COAST



## THREE GROUP OF SEAWEEDS

### Green (Chlorophyta)

- Pigments** : Chlorophyll a&b  
**Reserved food** : Starch  
**Examples** : *Ulva, Acetabularia* etc.



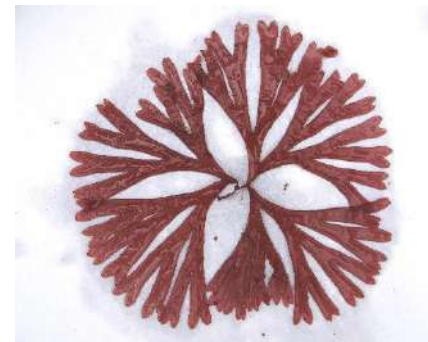
### Brown (Phaeophyta)

- Pigments** : Chlorophyll a & c, Fucoxanthin  
**Reserved food** : Mannitol, Laminaria  
**Examples** : *Padina, Sargassum* etc.

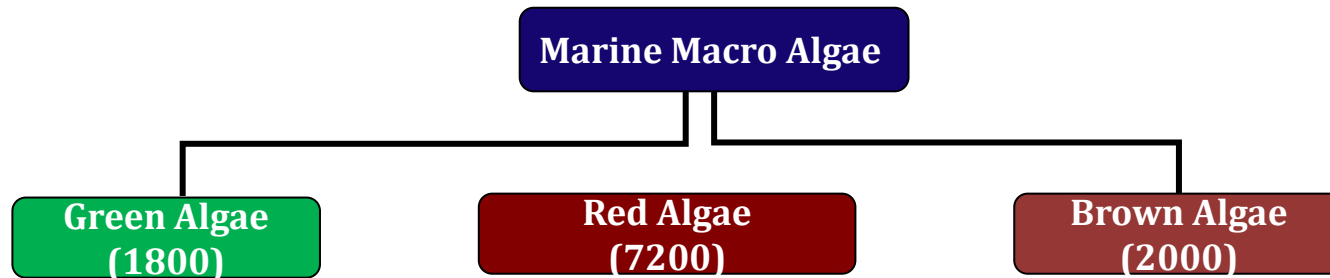


### Red (Rhodophyta)

- Pigments** : Chlorophyll a,d, carotene,  
phycoerythrin, phycocyanin  
**Reserved food** : Floridean starch  
**Examples** : *Gracilaria, Gelidium* etc.



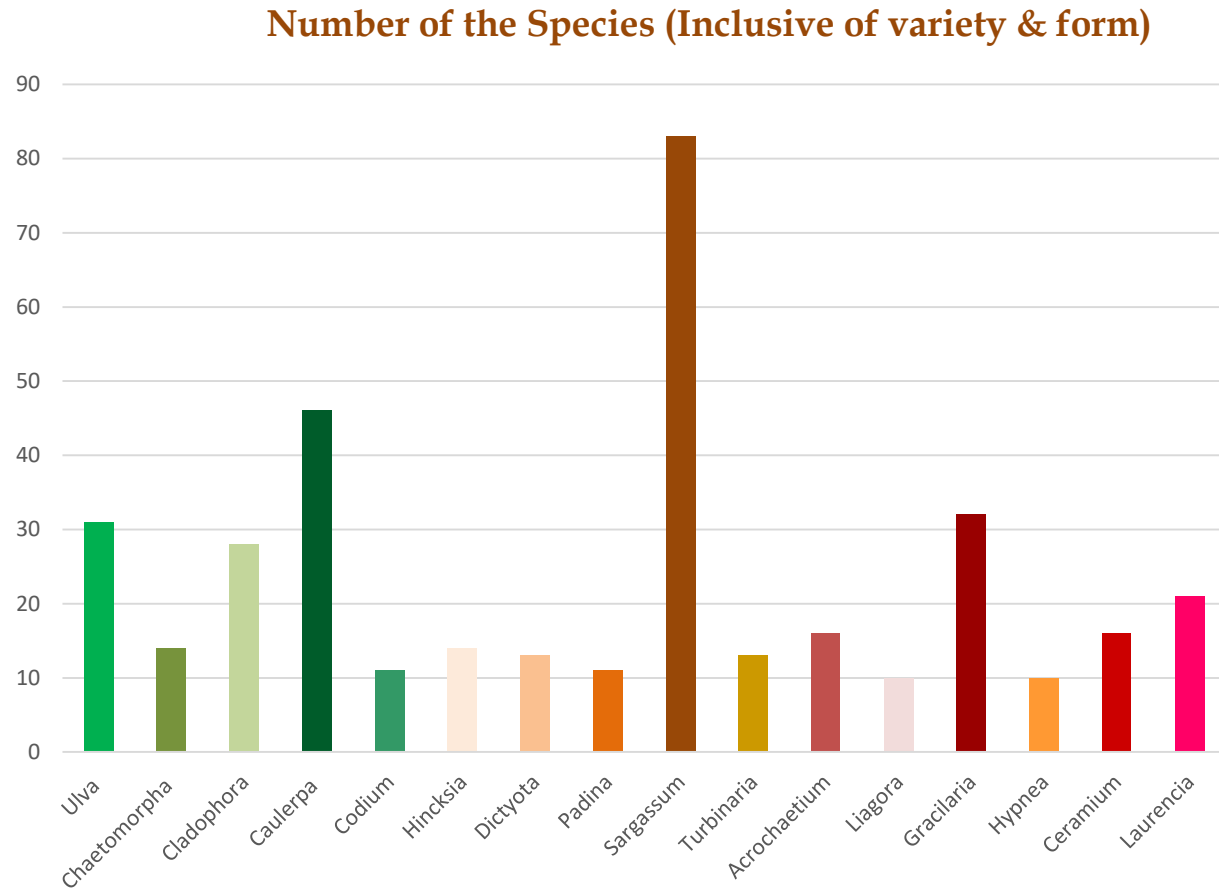
## STATUS OF MARINE MACRO ALGAE EXPORTED FROM THE COSTAL STATES OF INDIA



S.No	Seaweeds	World wide Distribution	In India	Family	Genera
1	Green (Chlorophyceae)	1800	212	19	46
2	Red (Rhodophyceae)	7200	442	33	138
3	Brown (Phaeophyceae)	2000	211	13	50
	<b>Total</b>	<b>11 000</b>	<b>865</b>	<b>65</b>	<b>234</b>

## Numerical account on the Dominant Genus of Marine algae in India

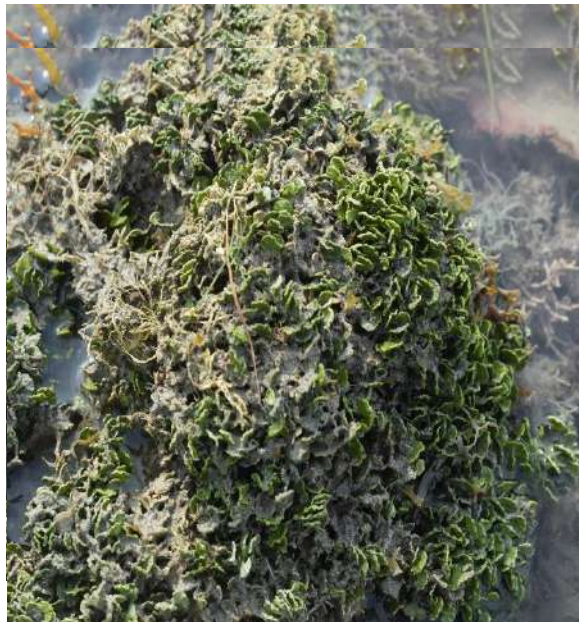
Name of the Genus	Total of the Species
<i>Ulva</i>	31
<i>Chaetomorpha</i>	14
<i>Cladophora</i>	28
<i>Caulerpa</i>	46
<i>Codium</i>	11
<i>Hincksia</i>	14
<i>Dictyota</i>	13
<i>Padina</i>	11
<i>Sargassum</i>	83
<i>Turbinaria</i>	13
<i>Acrochaetium</i>	16
<i>Liagora</i>	10
<i>Gracilaria</i>	32
<i>Hypnea</i>	10
<i>Ceramium</i>	16
<i>Laurencia</i>	21



**STATUS OF SEaweEDS REPORTED IN MARITIME STATES OF INDIA**

State/UT	Chlorophyceae	Phaeophyceae	Rhodophyceae	Total	Reference
West Bengal	09	---	05	14	Mukhopadhyay and Pal - 2002.
Odisha	09	02	10	21	Rath & Adhikary - 2006.
Andhra Pradesh	20	16	44	80 (134)*	Umamaheswararao & Sreeramulu - 1970. (*Palanisamy Aron Santhosh Kumar)
Tamil Nadu	113	83	225	421	Anon. - 1978.
Kerala	48	43	56	147	Palanisamy & Yadav - 2020.
Karnataka	36	30	42	108	Palanisamy & Yadav - 2018.
Goa	41	40	64	145	Pereira & Almeida - 2012.
Maharashtra	69	39	132	240	Sonali Piwalatkar - 2010.
Gujarat	54	35	109	198	Jha & al., - 2009.
Gulf of Kachchh	44	31	76	151	Kamboj & al., - 2019.
Andaman & Nicobar	24	19	36	79	Muthuvelan, - 1994.
Lakshadweep	43	14	54	111	Kaliaperum & al., - 1989.
Daman & Diu	27	14	29	70	Mantri and Subba Rao - 2005.

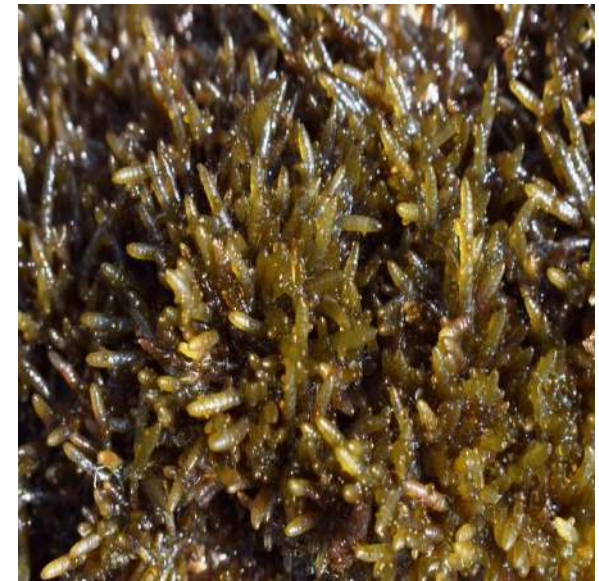
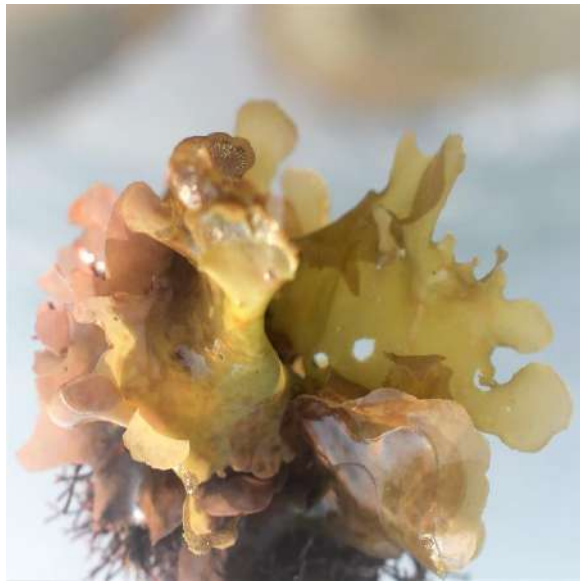
# MARINE MACRO ALGAE



# MARINE MACRO ALGAE



# MARINE MACRO ALGAE





<b>DELIVERABLES</b>	<b>SUMMARY OF ACHIEVEMENTS</b>
Total No. of Herbarium Prepared	<b>224</b> (from the previous collection from Gujarat coast during 10.03.2020 - 21.03.2020).
Total No. of Economically important	<b>50</b>
Total No. of Live specimens deposited	<b>40</b>
Total Nos. of Microscopic study/ Anatomical study	<b>20</b>
Total No. of Identified field numbers	<b>112</b>
Total No. of Collected References	<b>80</b>
Total No. of completed description	<b>250 Species</b> ( <b>Chlorophyceae: 112</b> + <b>Phaeophyceae: 38</b> + <b>Rhodophyceae :100 = 250</b> )

**Dr. M.Palanisamy: 150 Nos. of Taxa**

Description prepared for 150 Nos. of Taxa belong to 13 families of 21 genera under 6 orders of **Chlorophyceae and Phaeophyceae** in the prescribed format of BSI, Kolkata. The Class **Chlorophyceae includes, 112 taxa and class Phaeophyceae contains 38 taxa.** The description included the legitimated and valid taxa of Cladophoraceae (40 taxa), Dictyotaceae (34 taxa), Ulvaceae (25 taxa), Caulerpaceae (24 taxa), Bryopsidaceae (6 taxa), Ulvellaceae (4 taxa), Polyphysaceae (5 taxa), Codiaceae (4 taxa), Ectocarpaceae (3 taxa), Asteronemataceae (1 taxa), Chnoosporaceae (1 taxa), Gomontiaceae (1 taxa), and Monostromataceae (1 taxa).

**Dr. S.K. Yadav : 100 Nos. of Taxa**

Description prepared for 100 Taxa ( 11 order, 11 families and 26 genera) of **Rhodophyceae** in the prescribed format of BSI, Kolkata.

**EVENTUAL OUTCOME OF THE PROJECT**

S.No	Class	Order	Family	Genera	Species/Taxa
1	Chlorophyceae	4/7	9/19	15/46	112/212
2	Phaeophyceae	2/5	4/13	6/50	38/211
3	Rhodophyceae	11/19	11/33	26/138	100/442
	<b>Total</b>	<b>17/31</b>	<b>24/65</b>	<b>47/234</b>	<b>250/865</b>

## FORMAT OF MANUSCRIPT

## CHLOROPHYCEAE

## ULVALES

Plants are usually tubular or parenchymatous thalloid, capillary to broad, occasionally reduced to one or two rows of cells; attached or becoming free-floating; one or two cells in thickness. Cells possess one or two large lateral chromatophores with pyrenoids and single nucleus. Sexual and asexual plants are morphologically indistinguishable exhibiting isomorphic alternation of generations.

It includes, families of 8 families with 252 taxa in world (Guiry & Guiry, 2021) and in India it presents with Ulvaceae & Ulvellaceae (Rao & Gupta, 2015).

## ULVACEAE

Thallus green in colour, membranous, lettuce, translucent, tubular to foliose, variable in size and shape, up to 2 meters long, usually lithophytic or epilithic. Fronds striped to broader, margins entire, wavy to proliferate. Internally mono or distromatic; cells rectangular, quadrate or polygonal in surface view; chloroplast reticulate to peripheral with one to several pyrenoids. Its represented by single genera.

**Remarks:** On the basis of earlier works and available literatures *Ulva* & *Enteromorpha* are the two different genera fallen under family Ulvaceae. They are morphologically varied in size, ranging from few cm to several metres and thallus is tubular to leafy in nature. Also, internally, mono- or distromatic with quadrate to polygonal cells. In most of the literature, this genus is treated under two distinct genera i.e. *Enteromorpha* and *Ulva*. Hayden & al. (2003) ensured the molecular study on the two genera *Ulva* and *Enteromorpha*. The result of the molecular studies states that, both genera have similar molecular orientation. Henceforth, genus *Enteromorpha* merged under genus *Ulva* and the same is now followed in wide level.

*Ulva* L.

Thallus light-dark green in colour, foliose, mono or distromatic, membranous, simple, tubular, compressed, lobed or branched. Cells in surface view quadrate to polygonal; in cross section, cells palisade like, arranged in mucilaginous sheath; chloroplast single, plate like with one to several pyrenoid(s).

A total 130 taxa are available in worldwide under 13 genera (Guiry & Guiry, 2021), among them, *Ulva* is the common genera recorded all over the maritime states of India with 31 species are (Rao & Gupta, 2015).

***Ulva clathrata*** (Roth) C. Agardh, Disp. algar. 2: 23. 1811; P.S.N. Rao & Gupta, Algae India 3: 1. 2015;

*Enteromorpha clathrata* (Roth) Grev., Alg. Brit. 16: 181. 1830; V. Krishnam. & H.V. Joshi, Checkl. Ind. Mar. Alg.: 3. 1970; Sobha & Nair in Seaweed Res. Utiln. 8(1&2): 20. 1985; V. Krishnam., Alg. India Neighb. Countr. Chlorophycota 1: 89. 2000; P.C. Silva & al., Cat. Benth. Mar. Alg. Ind. Ocean: 72. 1996; Oza & Zaidi, Rev. Checkl. Ind. Mar. Alg.: 147. 2001; Sulekha & Panikkar in Seaweed Res. Utiln. 28(1): 6. 2006; Palanisamy & al. in Rajendran & Aravindhan (eds.), Biodiv. Cons. Biodiver. Conserv.: Asp. Prosp.: 34. 2015.

*Conferva clathrata* Roth, Cat. Bot. Fasc. 3: 175. 1806.

**Type locality:** Fehmarn, SW Baltic (Berger & al. 2003: 288). Neotype: LD 137737 (Berger & al. 2003: 288). Notes: Original material missing (Blomster et al., 1999; Hayden et al., 2003). Hayden et al. (2003: 288, table 4) select a neotype illustrated in Bliding (1963: figs 69a, b) from Landskoma, Baltic Oresund.

Plant body light-yellowish green, 3- 11 cm long, tubular, tufted, profusely branched throughout main axis, lithophilic. Holdfast minute, discoid, decisively attached on substratum. Stipe tubular, small, up to 1.5 mm long. Fronds cylindrical or tubular at base and narrowly compressed above, 0.5-3 mm in diameter, margins entire, apex obtuse or acute. Cells elongated, large, irregularly arranged, uninucleate; chloroplast plate-like, arranged towards cell wall, pyrenoids one to two.

**Occurrence:** Throughout the years. Moderate.

**Distribution:** Andaman & Nicobar Islands, Goa, Gujarat, Karnataka, Kerala Lakshadweep Islands, Maharashtra and Tamil Nadu.

**Specimen Examined:** Kerala Coast: Palanisamy & Yadav 127582, 128818, 128424, 12882, 128996 & 128928; Andhra Pradesh Coast: Palanisamy & Aron Santhosh Kumar 137522.

**Uses:** Utilized in biochemistry, since it has 20-26% content of Protein, 32-36%, Glucose (10-16%), Rhamnose (36-40%), Uronic acids (27-29%), and Xylose (10-13%).

**BOOK CHAPTER PUBLISHED: 01.**

1. PALANISAMY, M. & ARON SANTHOSH KUMAR, Y. 2020. *Marine Macro Algae*. In: Faunal Diversity of Biogeographic Zones: Coasts of India, Published by Zoological Survey of India, Kolkata: 749-783. ISBN 978-81-8171-543-2.

**PUBLISHED PAPERS: 03**

1. YADAV, S. K. & M. PALANISAMY. 2020. Eleven New Additions to Marine Macro Algal Flora of Karnataka Coast, India *Nelumbo* Vol. 62 (1): 90-102
2. YADAV S K, PALANISAMY M. AND MURTHY G V S. 2020. Seaweed resources of Kerala coast and its economic potential . *Madras Agric. J.*, Vol.107: 26-30 (special issue)
3. VIVEK S, ARON SANTHOSH KUMAR Y & M. PALANISAMY, 2020. Assessment of Secondary metabolites in the Yams of *Dioscorea oppositifolia* L. & *Dioscorea pentaphylla* L. In: Thangaraj Parimelazhagan (Ed.) *Phytomedicine: Research and Development- Book published by CRC Press: 262pages. ISBN 9780367857592 (190 – 195pp.)*.

**COMMUNICATED/ACCEPTED: 07**

1. PALANISAMY M & ARON SANTHOSH KUMAR Y. 2021. Review on monetary potential and bioprospecting of marine macroalgae from the coastline of Andhra Pradesh, India. *Agricultural Reviews. ( in review)*
2. VIANNY ANIMICA F, PALANISAMY M, ARON SANTHOSH KUMAR Y & VIVEK S. 2021. *Cloniophora plumosa* (Kuetz.) Bourr. (Cloniophoraceae, Ulvales) a taxon new distributional addition to algal flora of India. *Journal of Economic and Taxonomic Botany. ( in review)*
3. VIVEK S & M. PALANISAMY, 2021. "Significance of Seaweed Liquid Fertilizer (SLF) on Vegetable Crops *Solanum lycopersicum* L. (PKM 1) & *Abelmoschus esculentus* (L.) Moench (CO3)". *Gujarat Agricultural Universities Research Journal. (Article No. RA 58/20)*
4. VIANNY ANIMICA F & PALANISAMY M., 2021. *Spirotaenia erythrocephala* Itzigs. - A Zygnematophyceae member new to Algal flora of India. *Russian Journal of Botany (Article ID: BOTJOU2011A006FERNAND (Communicated)*
5. PALANISAMY M. , VIVEK S & ARON SANTHOSH KUMAR Y, 2019. "*Ipomoea pes-caprae* var. *perumkulamensis* Umam & Daniel (Convolvulaceae): An addition to the flora of Andhra Pradesh, India." *Indian Journal of Forestry (Article No. 6608). (Communicated)*
6. YADAV, S.K. AND M. PALANISAMY, 2019. Marine macro algal flora of St. Mary's Island, Karnataka, India. *Nelumbo*.
7. YADAV, S.K. AND M. PALANISAMY, 2019. A check list of marine macro algae of Karnataka coast, India. *Nelumbo*.

# PROPOSAL FOR THE YEAR 2021 – 2022

## DR. M. PALANISAMY

- Description for Remaining **273 taxa** of Chlorophyceae (100 taxa) and Phaeophyceae (173 taxa) will be prepared and submitted in the prescribed floral format of BSI.

## DR. S.K.YADAV

- Description for Remaining **342 taxa** of Rhodophyceae will be prepared and submitted in the prescribed floral format of BSI.

## EXTERNALLY FUNDED PROJECT

**Sponsor:** Ministry of MoEF & CC, New Delhi  
**Scheme:** AICOPTAX  
**Project Title:** “*Study of Diversity of Marine Macro Algae of Andhra Pradesh*”  
**Executing officials:** Dr. M. Palanisamy, Scientist -‘E’ &  
Shri. Aron Santhosh Kumar, Project Fellow  
**Date of initiation:** 29/12/2016  
**Date of completion:** 31/12/2019 (*Extended Up to December, 2021*)

*Duration of the Project period is completed on 31.12.2019. Also, the current project was extended for 2 more years (January, 2020 – December, 2021) by the competent authority (Review committee members) of MoEF & CC, New Delhi [Ref. No. F. No. 22018/22/2015-RE (Tax) dt.16.08.2019].*

### ANNUAL OUTCOME (2020 – 2021)

- The present study reveals that, **134 taxa of seaweeds** were reported from the coastline of Andhra Pradesh (*Annexure – III*). Among them, **one taxon** new addition to India, **25 taxa** were **new distributional additions** to the state flora of Andhra Pradesh. The **prospects, commercial and economic values of the 58 taxa of the marine macro algae** from Andhra Pradesh were inventoried.
- The preparation of *e-flora* and other objectives are in process.
- Also, **Conducted Ph.D. doctoral committee Metting-1** of. Shri.Aron Santhosh Kumar Y (Project Fellow) under this AICOPTAX Project in BSI, SRC, Coimbatore on 03.07.2020.
- The Ph.D. doctoral committee Metting-1 report sent to Bharathiar University through HOO. SRC, Coimbatore.

**Accepted: 01**

1. **PALANISAMY M & ARON SANTHOSH KUMAR Y. 2021.** Review on monetary potential and Bioprospecting of marine macro algae from the coastline of Andhra Pradesh, India. *Agricultural Reviews*.

- ❖ **Identified and authenticated 199 Nos. of marine macro algal specimens** for the students, research scholars, lecturers, scientists & private firm from different states of India.
- ❖ **Reviewed three algal manuscripts** for Nelumbo Journal.
- ❖ Prepared the **scientific report on “Phytoplankton biomass of east coast of India”**; Detailed about the diversity, distribution, occurrence, threats and conservation measurements of Micro algal community. The same was **submitted to MoEF & CC, New Delhi**, through Director, BSI, Kolkata for discussion at Lok Sabha on 05.03.2021.
- ❖ **Recommendations and suggestions were prepared on “Ocean Accounts Diagnostic Tool”** (Forwarded by MoSP, New Delhi.) and submitted to Director, BSI, Kolkata to forward the same to MoEF & CC, New Delhi on 25.03.2021.
- ❖ **Evaluated the Ph.D. thesis of two students and Conducted Viva voce examination** for the recommendation and to award the Ph.D. Degree on through online mode.
- ❖ Prepared a **report on Indian Antarctic Expedition 2003-04** (Experience during voyage to Antarctica, Experience stays at Antarctica, Research work in Antarctica and other information) and the same was submitted to Director, BSI, Kolkata.
- ❖ Total of **40 Nos. of misidentified and misapplied specimens were found and determinate slips** were over pasted for rectification at CSIR- CSMCRI – MARS, Ramnad, Tamil Nadu during herbarium consultation tour *w.e.f.* 30.03.2021 – 31.03.2021.
- ❖ Signed as **Resource person to lead the technical session** on “*Marine Macro Algal Diversity in India*” to Department of Botany, Sri Parasakthi College for Women, Coutrallam on 29.08.2020 through the webinar.
- ❖ Performed as **Chairperson** to conduct the “*Botany association MEET -2020*” at PG Dept. of Botany, Mahatma Gandhi Arts College, Mahe, Govt. of Puducherry on 16-12-2020 through webinar.
- ❖ Signed as the **Panel person of** the “*National Conference on Deep Sea Bioresources in Indian Ocean*” organized by ZSI (under MoEF & CC), Kolkata *w.e.f.* 24.02.2021 – 25.02.2021.
- ❖ **Subjected as Expert of “Seaweeds & Seagrass”** in Post Graduate Diploma on Integrative Animal taxonomy Organized by ZSI, Kolkata Sponsored by MoEF & CC, New Delhi on 25.02.2021.
- ❖ Assigned as **Chief Guest** in the Ceremony of “*World Meteorological day - 2021*” to launch the Proceeding on **Impacts of Climate** organized by Agro Climate Research Centre, TNAU, Coimbatore on 23.03.2021.



**THANK YOU ALL**